

CLAIMS

1. Fluid processing apparatus for use in an elongate passage, the apparatus comprising a plurality of means for applying ultrasonic energy to fluid within the passage positioned axially along the elongate passage, wherein axially adjacent means for applying ultrasonic energy are radially non-parallel and radially non-opposing.
- 10 2. Apparatus according to claim 1 wherein axially adjacent means for applying ultrasonic energy are relatively radially displaced by an angle between 0° and 90°.
- 15 3. Apparatus according to claim 2 wherein the angle is from 30° to 60°.
4. Apparatus according to claim 3 wherein the angle is substantially 45°.
- 20 5. Apparatus according to any preceding claim which comprises five or more means for applying ultrasonic energy contained within the same elongate passage.
6. Apparatus according to any preceding claim wherein alternate means for applying ultrasonic energy are radially aligned.
- 25 7. Apparatus according to any preceding claim which comprises five means for applying ultrasonic energy, in which 30 the means for applying ultrasonic energy are radially symmetrically disposed either side of a line parallel with the longitudinal axis of the elongate passage.

8. Apparatus according to claim 7 wherein the first, third and fifth means for applying ultrasonic energy are substantially in radial alignment disposed on one side of the line, and the second and fourth means for applying ultrasonic 5 energy are substantially in radial alignment disposed by a substantially equal amount on the other side of the line.

9. Apparatus according to any preceding claim wherein axially adjacent means for applying ultrasonic energy are 10 axially spaced by an amount from 30 to 40mm.

10. Apparatus according to any preceding claim wherein each means for applying ultrasonic energy may be activated independently.

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11. Apparatus according to any preceding claim wherein each means for applying ultrasonic energy preferably comprises an operating member connected to a vibration member, the operating member being connected to a source of ultrasonic 20 energy.

12. Apparatus according to claim 11 wherein the means for applying ultrasonic energy has an inner passage through which fluid flowing through the apparatus passes.

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13. Apparatus according to claim 12 wherein an inner surface of the inner passage is arranged to vibrate radially.

14. Apparatus according to claim 12 or 13 wherein the 30 longitudinal axis of the inner passage of each means for applying ultrasonic energy is substantially coincident with the longitudinal axis of the elongate passage.

15. Apparatus according to any preceding claim which further comprises means for constraining flow of fluid towards the longitudinal axis of the elongate passage.

16. Apparatus according to claim 15, wherein said means for constraining flow of fluid comprises a funnelling device.

17. Apparatus according to claim 15 or 16, wherein said funnelling device is operative to reduce the cross-sectional area through which fluid flows by at least a factor of 4.

18. Apparatus according to claim 17, wherein said funnelling device is operative to reduce the cross-sectional area through which fluid flows by at least a factor of 8.

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19. Apparatus according to any one of claims 15 to 18, wherein the funnelling device is located within the elongate passage upstream of the one or more means for applying ultrasonic energy.

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20. Apparatus according to any preceding claim wherein each means for applying ultrasonic energy comprises a vibration member having an inner passage.

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21. Apparatus according to any preceding claim, wherein the means for applying ultrasonic energy comprises an extender element for projecting an operating member into said elongate passage, said apparatus further comprising flushing means for flushing detritus from said extender element.

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22. Fluid processing apparatus for use in an elongate passage, the apparatus comprising a means for applying ultrasonic energy to fluid within the passage, said means for

applying ultrasonic energy comprising an extender element for projecting an operating member into said elongate passage, said apparatus further comprising flushing means for flushing detritus from said extender element.

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23. Apparatus according to claim 22 or 23, wherein said flushing means comprises one or more nozzles provided at or adjacent said extender element.

10 24. Apparatus according to claim 23, wherein the one or more nozzles are housed in a wall of a chamber through which the extender element projects.

25. Apparatus according to any one of claims 21 to 24, 15 wherein the apparatus further comprises a plurality of means for applying ultrasonic energy arranged with their operating members along a common longitudinal axis, adjacent extender elements being angularly offset with respect to one another.

20 26. Apparatus according to claim 25, wherein the plurality of means for applying ultrasonic energy are arranged in a "V" formation.

27. Apparatus according to any one of claims 21 to 26, 25 wherein the nozzles incorporate actuated valves.

28. Apparatus according to any one of claims 21 to 27, wherein supply of fluid to the nozzles is controlled automatically, in response to a draw in power from the means 30 for applying ultrasonic energy.

29. Fluid processing apparatus for use in an elongate passage, the apparatus comprising a means for applying

ultrasonic energy to fluid within the passage, said apparatus further comprising flushing means for flushing detritus from said apparatus, said flushing means comprising a flushing nozzle for directing flushing media towards an outer surface 5 of a substantially conical surface provided within the passage.

30. Apparatus according to claim 31, wherein the outer conical surface is formed by an outer surface of a funnelling 10 device provided in the passage.

31. A method of treating fluids, the method comprising placing the fluid processing apparatus of any preceding claim into an elongate passage and passing the fluid through the 15 elongate passage.

32. A method according to claim 31 wherein the fluid is sewage sludge.

20 33. A method according to claim 31 or 32 wherein the elongate passage is aligned substantially vertically.

34. Fluid processing apparatus substantially as hereinbefore described with reference to the accompanying drawings.

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35. A method substantially as hereinbefore described.